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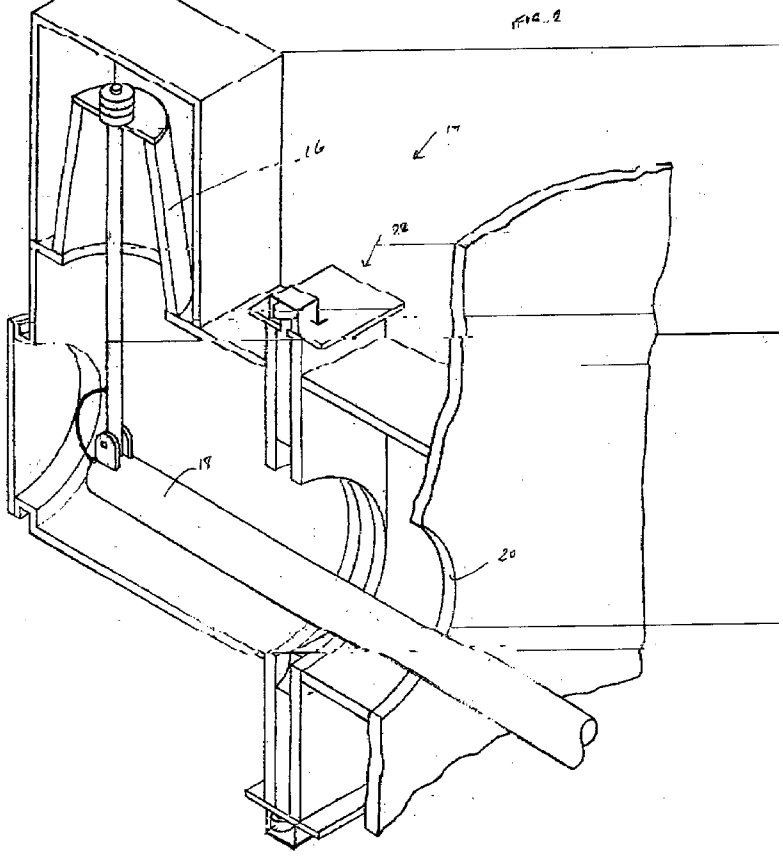
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[Continued on next page]

(54) Title: GATE OR DAMPER STRUCTURE IN WET ELECTROSTATIC PRECIPITATOR



(57) Abstract: A damper arrangement is described which provides for selective separation of the insulator compartments from the main body of a wet electrostatic precipitator (WESP), permitting maintenance to be performed on the insulator in the compartment while process gas continues to flow through the WESP.

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Published:
— *with international search report*

TITLE OF INVENTION

GATE OR DAMPER STRUCTURE IN WET ELECTROSTATIC PRECIPITATOR

FIELD OF INVENTION

[0001] The present invention is concerned with access to insulators in a wet electrostatic precipitator (WESP) to perform insulator maintenance by the use of a gate or damper structure.

BACKGROUND OF THE INVENTION

[0002] WESPs have been used for many years to remove dust, acid mist and other particulates from water-saturated air and other gases by electrostatic means. In a WESP, particulate and mist laden gas flows between discharge and collecting electrodes, where the particulate and mist are charged by a high intensity corona emitted from the high voltage discharge electrodes. As the gas flows further within the WESP, the charged particulate matter and mist is electrostatically attracted to grounded collecting plates or electrodes, where it is collected. The collected materials are washed off by an irrigation film of water.

[0003] The design of the WESP utilizes negatively charged high voltage discharge electrodes separated from the grounded collecting electrodes by porcelain or ceramic insulators. The insulators are mounted external to the process gas stream. This type of system is used to remove pollutants from various industrial gas streams, such as chemical incinerators, coke ovens, ceramic brick furnaces, coal fired power plants, multi-fuelled power plant, food drying plants, non-ferrous metallurgical plants and petrochemical plants.

[0004] In certain industries, such as the petrochemical industry, a WESP is required to be operating for long periods of time, generally up to 60 months, and cannot be shut down for maintenance. This extended period of

operation raises problems with overall maintenance, but especially insulator maintenance.

SUMMARY OF INVENTION

[0005] The present invention provides a system which provides access to insulators on a WESP to enable maintenance to be performed on the insulator, while process gas continuously passes through the WESP.

[0006] In this regard, a gate or a damper arrangement is used to isolate the insulator from the process gas while the insulator compartment under maintenance is de-energized and locked out.

[0007] In accordance with one aspect of the present invention, there is provided, in an electrostatic precipitator having a body and a grid of electrode elements within the body, a plurality of electro-conducting support arms connected to and supporting the grid, each of said support arms extending through a port in a wall of the electrostatic precipitator surrounding the grid of electrode elements to an external insulator compartment and terminating on an insulator which insulates the support arm from the body of the electrostatic precipitator, the improvement which comprises a damper located in the insulator compartment and effective to selectively seal off the interior of the insulator compartment from gases flowing through the electrostatic precipitaror.

BRIEF DESCRIPTION OF DRAWINGS

[0008] Figure 1 is a general perspective view with parts cut away of a wet electrostatic precipitator;

[0009] Figure 2 is a close up perspective view of a portion of the wet electrostatic precipitator of Figure 1, showing details of the gate structure provided in accordance with one aspect of the present invention;

[0010] Figure 3 is a sectional view of Figure 2;

[0011] Figure 4 contains a close up perspective view of the gate structure of one embodiment of the present invention in the open (Fig. 4A) and closed (Fig. 4B) positions;

[0012] Figure 5 is a front elevational view of the gate structure of Figure 3 in the open (Fig. 5A) and closed (Fig. 5B) positions; and

[0013] Figure 6 is a detailed perspective view of a double-walled gate structure according to one embodiment of the present invention.

GENERAL DESCRIPTION OF THE INVENTION

[0014] The blades of the damper arrangement may be a sliding type or a swinging gate type to close off the high voltage frame opening into the WESP. The blades can be manually operated or operated with an automatic actuator.

[0015] To ensure a man-safe environment, close tolerances must be maintained between the damper blade and the high voltage (HV) support frame. A flexible seal may be used to reduce air leakage.

[0016] Alternatively, a double-walled damper with sealing air that has a higher pressure than the process gas may be used to prevent process gas from entering the insulator compartment and to allow a positive seal pressure around the HV support frame. An adjusting mechanism may be used on the damper blades so that, when the damper blades are actuated, the HV support frames are re-aligned to their correct position, in case any movement or shifting has occurred due to a failure of the insulator. Reference points may be used to determine the correct position of the HV frame relative to its position at commissioning, or when the latest internal maintenance was performed.

[0017] An inspection port or window may be used to view the damper position before opening the access door.

[0018] For operator safety, key interlocks may be used to ensure that the damper position cannot be changed while the WESP is de-energized.

DESCRIPTION OF PREFERRED EMBODIMENT

[0019] Referring to the drawings, Figure 1 shows a typical WESP structure 10 with parts cut-away to show a high voltage frame 12 which supports the electrodes 13 of the WESP. The WESP structure 10 includes insulator compartments 14 containing insulators 16.

[0020] Figures 2 and 3 are respectively perspective and sectional views of a detail of the insulator compartment 14 containing the insulators 16. As may be seen, the insulator 16 supports an end of element 18 of the high voltage frame 12. The insulator component 14 generally is in fluid flow communication with the process gas stream passing through the WESP through an opening 20 in the wall of the WESP.

[0021] In accordance with the present invention, there is provided a damper arrangement 22 which enables the insulator compartment 14 to be isolated from the WESP 10. As may be seen, the damper arrangement 22 comprises a pair of gates elements 24 and 26, which slidably move from the open position (Figures 4A and 5A) towards each other by any suitable mechanism to engage and surround the end element 18 in the closed position (Figures 4B and 5B), thereby closing off the insulator compartment 14 from the gases flowing through the WESP.

[0022] In their closed position, the gate elements 24 and 26 preferably define a hollow cavity 28 into which purge air having a higher pressure than the process gas may be flowed to completely seal off the process gas from the insulator compartment 14. This arrangement is illustrated in Figure 6.

[0023] De-energizing of the end element 18 is effected prior to closing the damper arrangement 22. Access to the insulator component 14 then may be safely made for maintenance of the insulator 16 while process air continues to flow through the WESP 10.

[0024] When service to the insulator compartments is complete, the gate elements are opened by withdrawing them to their retracted positions (Figs. 4A and 5A). Normal operation of the WESP is resumed.

SUMMARY OF THE INVENTION

[0025] In summary of this disclosure, there is provided a gate or damper arrangement that provides selective separation of the insulator compartment from the main body of the WESP, thus allowing maintenance to be performed on the insulator, while process gas continues to flow through the WESP. Modifications are possible within the scope of the invention.

Claims

1. In an electrostatic precipitator having a body and a grid of electrode elements within said body, a plurality of electro-conducting support arms connected to and supporting the grid, each of said support arms extending through a port in a wall of the electrostatic precipitator surrounding said grid of electrode elements to an external insulator compartment and terminating on an insulator which insulates the support arm from the body of the electrostatic precipitator, the improvement which comprises a damper located in the insulator compartment and effective to selectively seal off the interior of the insulator compartment from gases flowing through the electrostatic precipitator.

2. The electrostatic precipitator of claim 1, wherein said damper requires a wall spanning the insulator compartment and defining an opening through which said support arm extends and at least one closure element selectively moveable between a first position in which said opening is at least partially unobstructed and a second position in which the opening is completely obstructed.

3. The electrostatic precipitator of claim 2 wherein said closure element comprises a part of plates moveable into and off of engagement with each other and encasing said support arm.

4. The electrostatic precipitator of claim 3 wherein one of said pair of plates comprises first and second spaced-apart plates, whereby, when said pair of plates is in said arrangement position, said first and second spaced apart plates define a cavity into which pressurized air at a pressure greater than the process gas may be passed to ensure a hermetic seal with the support arm.

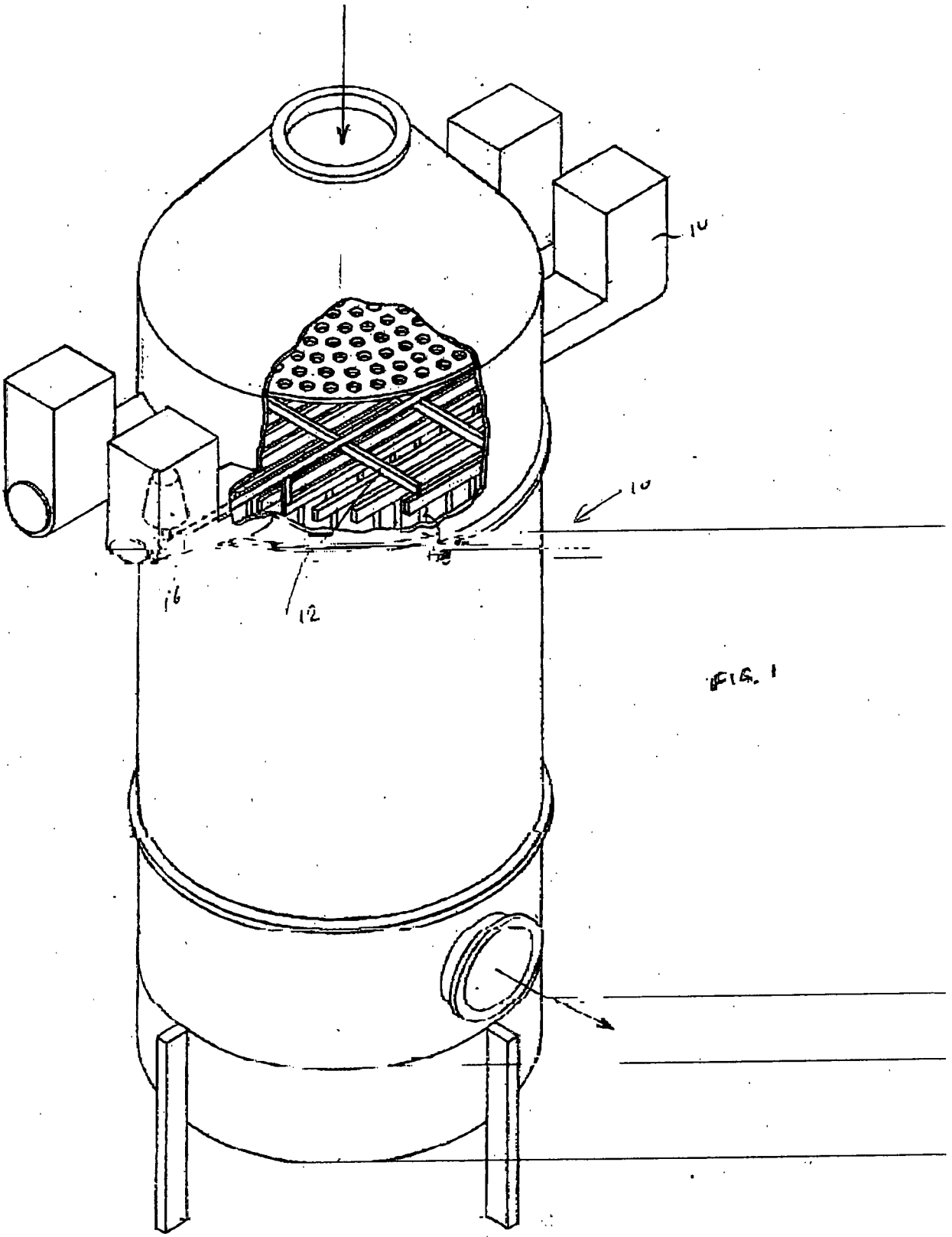
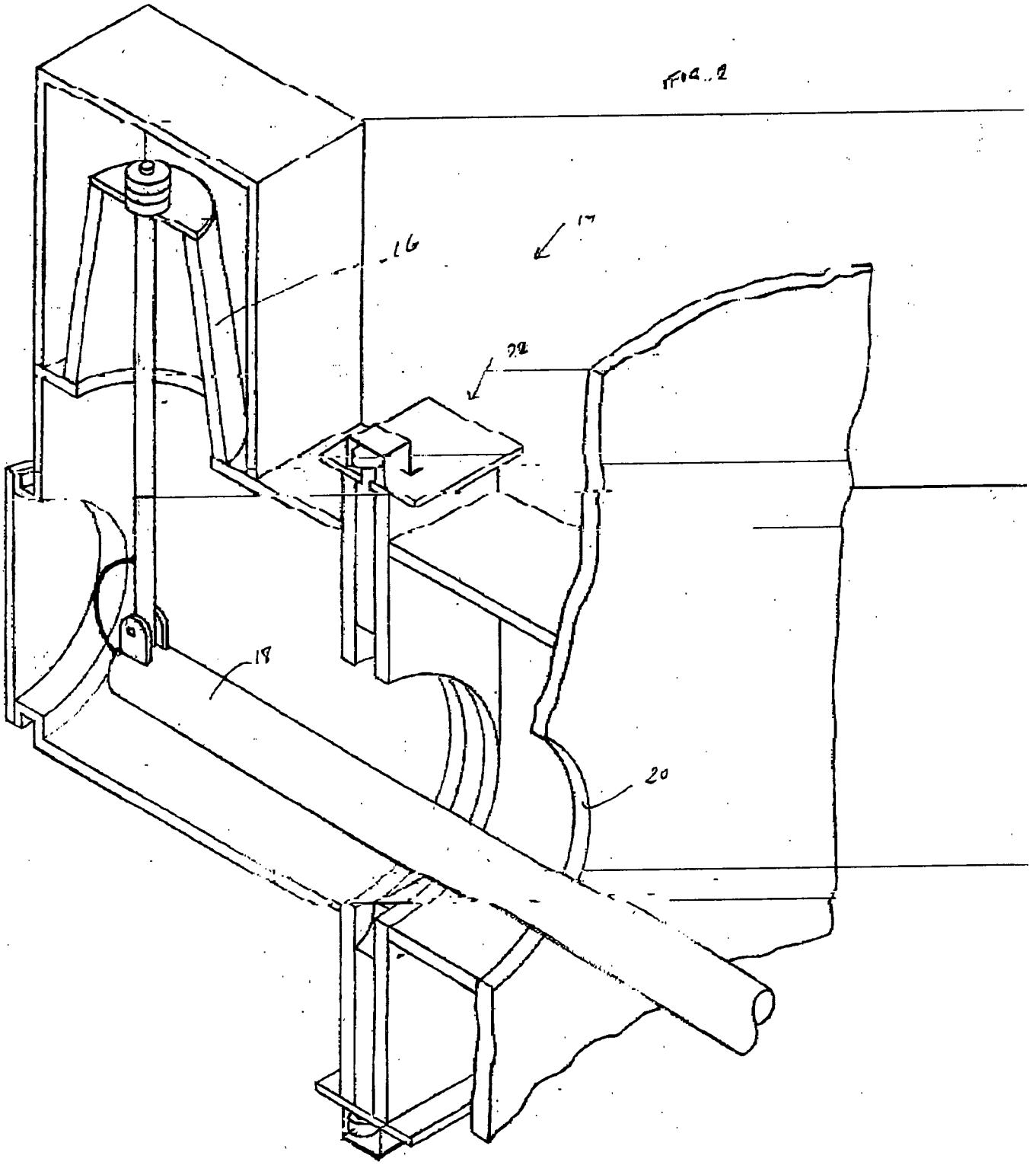


FIG. 1


FIG. 2
16
17
22
18
20

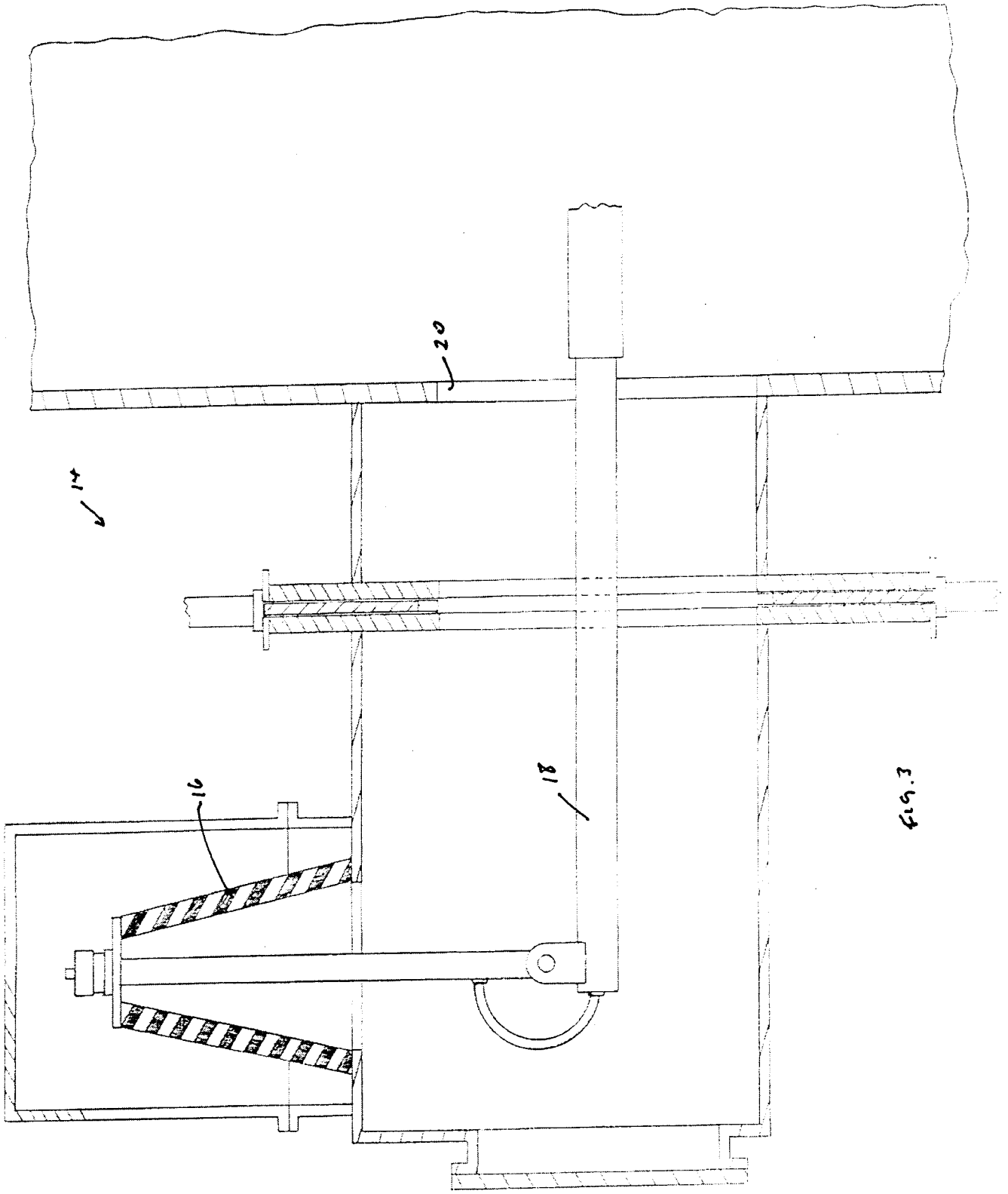


FIG. 3

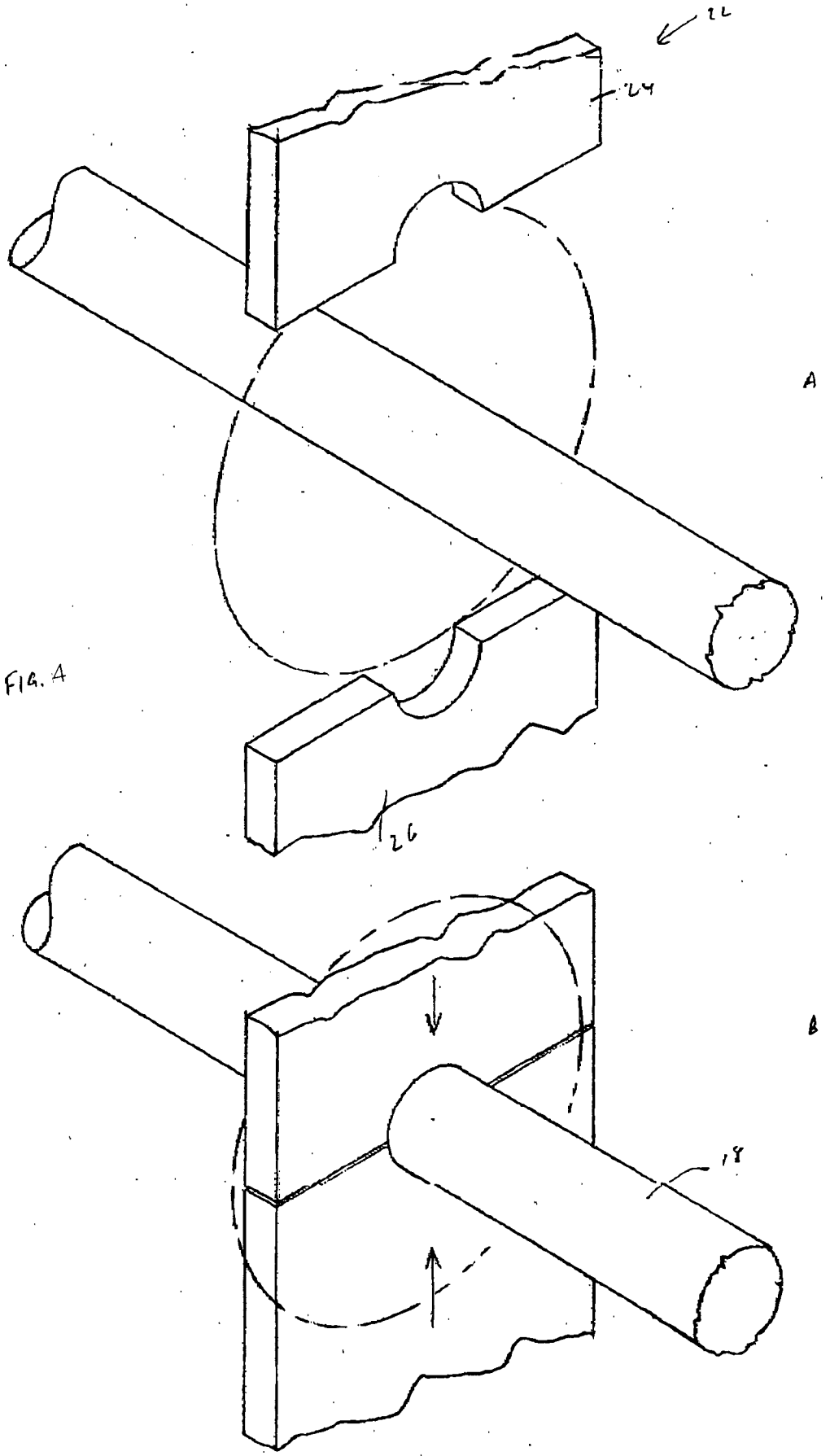


FIG. 4

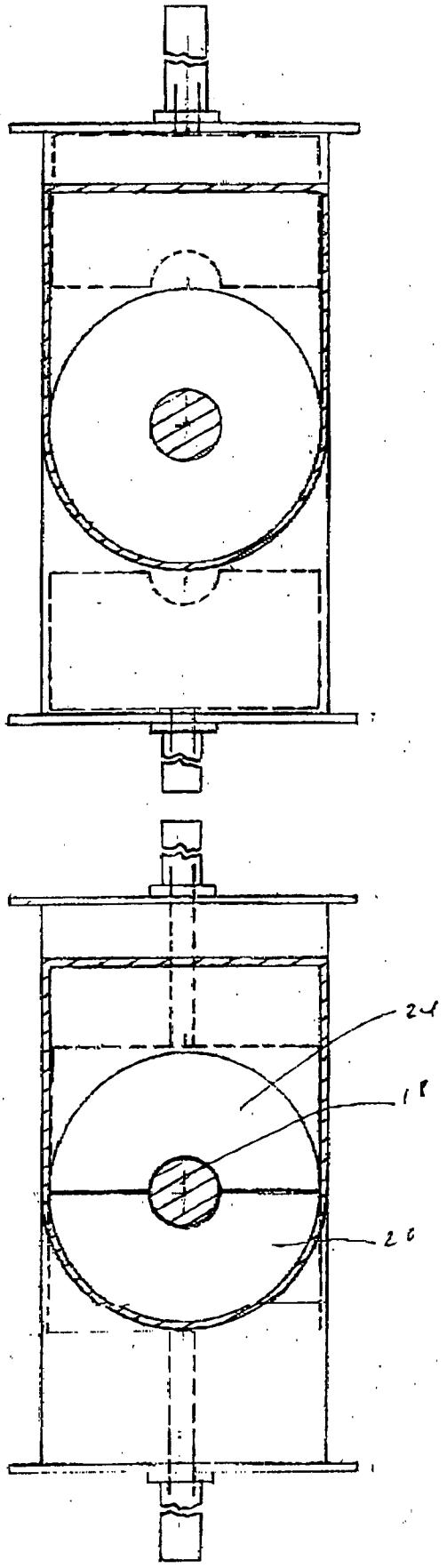


FIG. 5

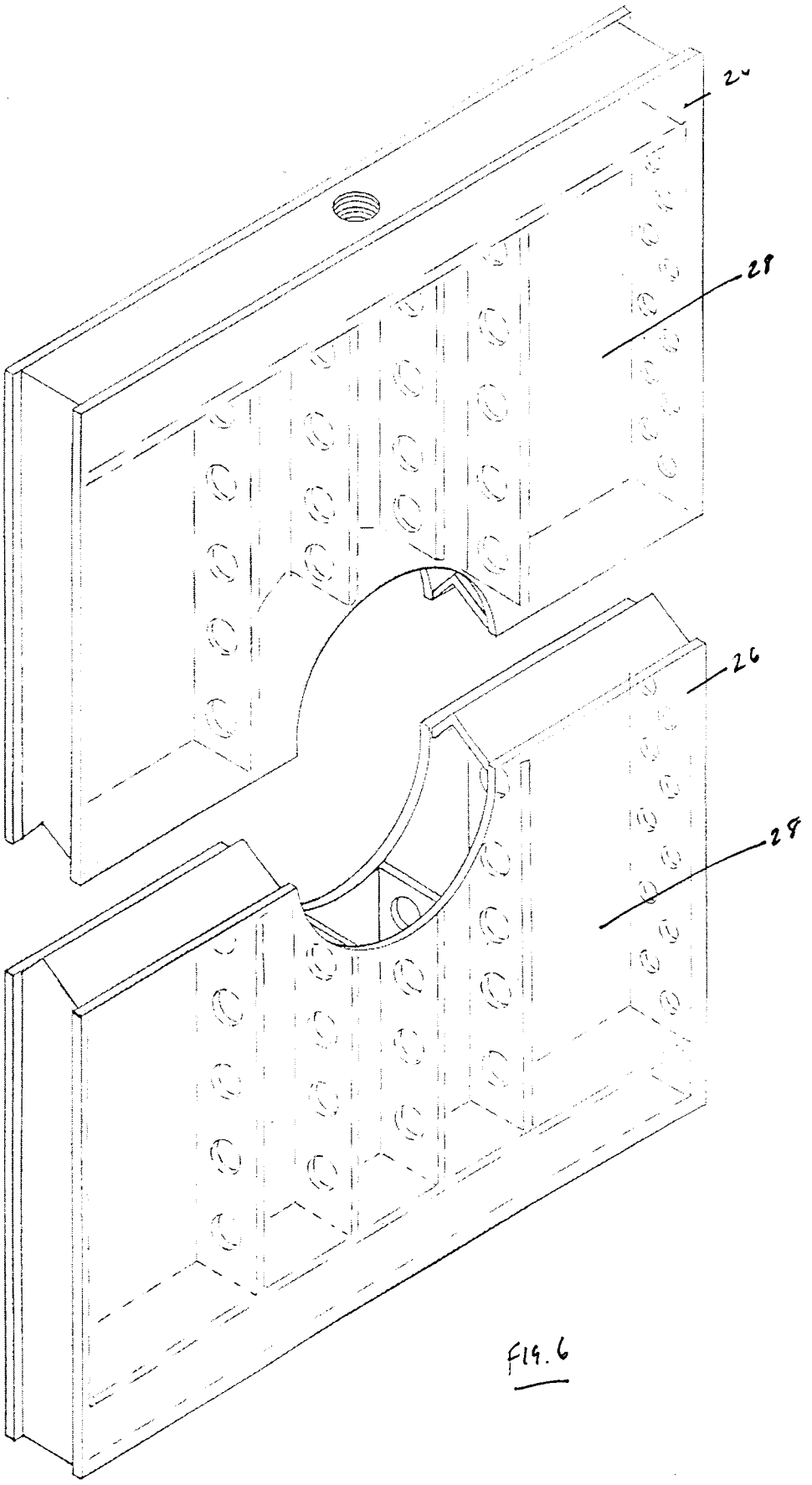


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***B03C 3/36*** (2006.01) , ***B03C 3/16*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: B03C 3/36; B03C 3/16; B03C 3/34; B03C 5/02; B03C 11/00; F01N 3/01
US Cl. 55/104, 286, 288, 484; 60/275, 288, 297; 95/273; 96/018, 062, 088; 137/112; 422/169

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
None

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Google Scholar DELPHION (all collections) ESPACENET Japanese Patent Database
IEEE Online Database Korean Patent Database Canadian Patent Database
search terms used: electrostatic, electrode, filter, precipitator, grid, damper, gate, diverter, valve, flow, insulat*, bypass, divert, isolate, maintenance, service, repair, maintain, clean*, selective, block*, particulate, insulator compartment, insulator chamber, replace,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2806896 A (STREUBER ET AL.) (17 September 1957) (17-09-1957)	1 to 4
A	US 2567709 A (RESEARCH CORPORATION) (11 September 1951) (11-09-1951)	1 to 4
A	US 4439216 A (COMBUSTION ENGINEERING, INC.) (27 March 1984) (27-03-1984)	1 to 4
A	US 4522634 A (WALTHER & CIE AKTIENGESELLSCHAFT)	1 to 4

[ ] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 June 2008 (17-June-2008)	21 July 2008 (21-07-2008)

Name and mailing address of the ISA/CA	Authorized officer
Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Daniel Weslake 819- 997-2999

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
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